

# The atoll source 4U 1608–52 is not a Z source!

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**Abstract.** We have studied the spectral and timing behaviour of the atoll source 4U 1608–52. We find that the timing behaviour of 4U 1608–52 is almost identical to that of the atoll sources 4U 0614+09 and 4U 1728–34. Recently Munro, Remillard & Chakrabarty (2002) and Gierlinski & Done (2002) suggested that the atoll sources trace out similar three-branch patterns as the Z sources. The timing behaviour is not consistent with the idea that 4U 1608–52 traces out a three-branched Z shape in the color-color diagram along which the timing properties vary gradually.

## 1. Introduction and Data Analysis

In this work we use all available data from RXTE’s PCA to simultaneously study the spectral and timing properties in the transient low mass X-ray binary 4U 1608–52. We calculate a color-color diagram. As the energy spectrum of a source changes, it moves through the diagram. To study the timing we calculate Fourier power density spectra and fit them with the multi-Lorentzian fit function; a sum of Lorentzian components plus an occasional power law to fit the very low frequency noise [1, 2]. It has been recently proposed [3, 4] that the atoll sources trace out similar three-branch patterns as the Z sources; one of our goals in this work is to test this hypothesis.

## 2. Stepping through the color-color diagram

As a first step we go through the data in chronological order and look at the timing properties (per observation) and the position of the source in the color-color diagram. The obtained lightcurve and color-color diagram for 4U 1608–52 can be grouped into 3 parts. The first part ranges from 1996 March 3 to December 28 (the decay of the 1996 outburst, see [5]), the second part from 1998 February 3 to September 29 (the 1998 outburst, see [6]) and the third part from 2000 March 6 to May 10. In practice most data was available for the second part of the lightcurve (the 1998 outburst) so we will present the results for the second part of the lightcurve first. The results can then serve as a template for the rest of the data.

For the 1998 outburst we find 7 different color diagram position/power spectral classes and we can confirm the result of [6] that the color-color diagram shows the classical atoll C shape (see [7]). For the decay of the 1996 outburst we find one additional class that was different from those observed during the 1998



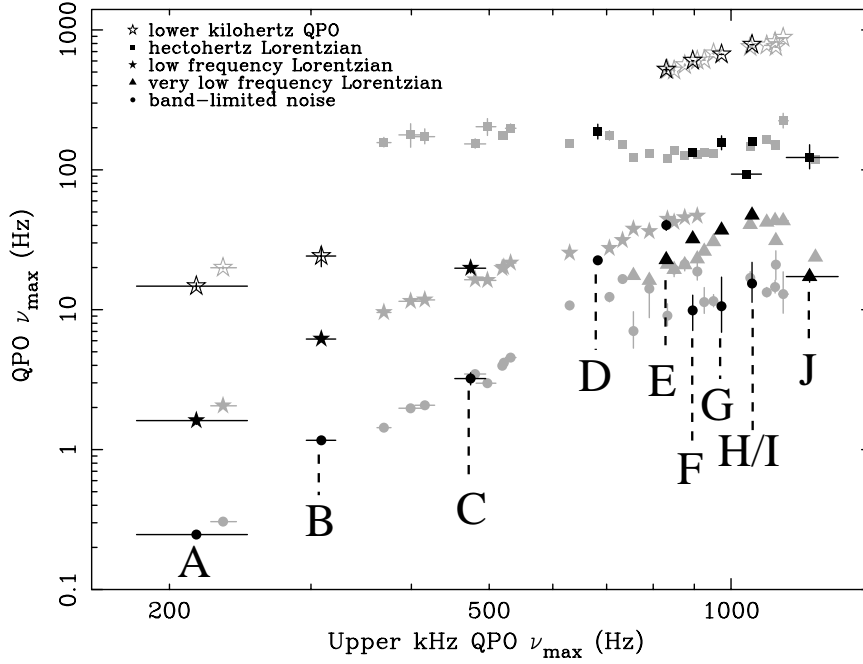


Figure 2. Correlations between the characteristic frequencies of the several Lorentzians used to fit the power spectra of 4U 1608–52 and the characteristic frequency of the Lorentzian identified as the upper kilohertz QPO. The black points mark the results for 4U 1608–52, the grey points the results for 4U 1728–34 and 4U 0614+09. The symbols mark the different power spectral components. The letters mark the intervals of Figure ?? . Note that the identification of the lower kilohertz QPO at low frequencies (intervals A and B) is uncertain.

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